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Front Cover: Juvenile plant of *T. peltatum* one year after germination, Botanical Garden of Würzburg, see article on page 7. Photo by H. Rischer.

Back Cover: *Cephalotus follicularis*, see article on page 30. Photo by Ron Parsons.

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Letter From The Editor: Election News

Barry Meyers-Rice

The 1998 elections have concluded and the six successful candidates were (in alphabetical order) Madeleine Groves, Jay Lechtman, Joe Mazrimas, Carl Mazur, Barry Meyers-Rice, and Jan Schlauer. This sextet will be joined by the 1998 ICPS president Rick Walker to form the new Board of Governors. As I write this, the Board has just begun its business and in the coming weeks will develop plans for the ICPS's future.

One of the important tasks the ICPS must address is how the Society relates to its many Chapters. At present there are no official benefits or guidelines for its Chapters. To help us change this, we would like to hear from every ICPS chapter. Please send a letter to us, describing who you are, how many people are in your Chapter, and what geographic range you span.

A Carnivorous Plant on an Irish Postage Stamp: David Moore and *Sarracenia* Hybrids at Glasnevin Botanic Gardens

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Keywords: history: David Moore, Ireland, *Sarracenia*.

In September 1995, to commemorate the bicentenary of the foundation of the National Botanic Gardens, Glasnevin, Dublin, the Irish Post office issued a set of stamps including one depicting a carnivorous plant. The set comprises *Crinum moorei* (32p), a lily from Natal named after Dr. David Moore, *Solanum crispum* 'Glasnevin' (44p), a cultivar of the potato vine, and *Sarracenia* × *moorei* (38p, see Figure 1). The issue included a souvenir booklet with the stamps set in a strip and as a block of four (two 32p, and one each 38p and 44p). The stamps were designed by Frances Poskitt and were released on 9 October.

Why was *Sarracenia* × *moorei* chosen for this issue? It was the first artificial hybrid pitcher plant and was raised in the early 1870s at Glasnevin, then known as the Royal Dublin Society's Botanic Gardens, Glasnevin. Situated a few kilometres north of the centre of Dublin, the Gardens still flourish and today are known as the National Botanic Gardens, Glasnevin; for many years—from about 1870 until 1922 when the Irish Free State was established—they bore the name Royal Botanic Gardens, Glasnevin (see note 1).

Almost as multifarious as the names for the gardens in Glasnevin are the names applied to the hybrid resulting from the deliberate cross-pollination of *Sarracenia flava* and *S. leucophylla*. All plants arising from that cross, whether naturally occurring or artificially created, have only one correct name: *Sarracenia* × *moorei* [Anonymous ex] Masters. *S.* × *mooreana* Veitch is a superfluous synonym which should be abandoned as I have pointed out elsewhere (see note 2); its continued use is contrary to the International Code of Botanical Nomenclature.

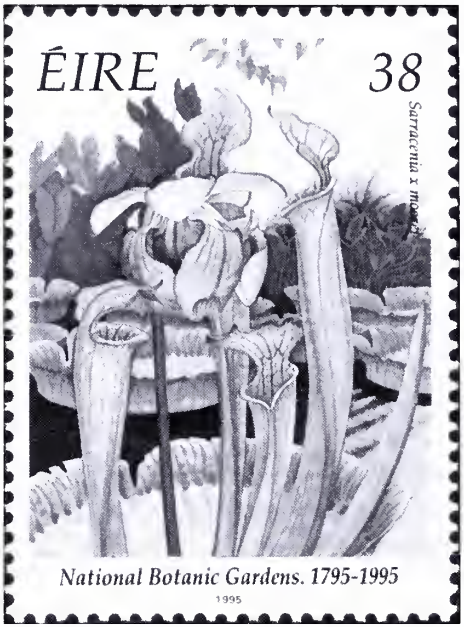

Figure 1: The *Sarracenia* × *moorei* stamp.

The hybrid was named after Dr. David Moore (see note 3), Director of Glasnevin Botanic Gardens from 1838 to 1879. David was a Scot, a native of Dundee. His father and grandfather were gardeners, and David (and his younger brother Charles) evidently absorbed their love of plants. It must also be said that Scotland's unique system of education in the eighteenth and nineteenth centuries was conducive to the production of gardener-botanists of outstanding calibre with a depth of knowledge equalled by few modern horticulturists or botanists (see note 4). While still in his teens, David moved from Scotland to Dublin as an assistant gardener in the city's other botanic garden, that attached to the University of Dublin (Trinity College). At the College Botanic Garden situated in Ballsbridge, one of Dublin's southern suburbs, David's botanical education and horticultural training continued under the guidance of James Townsend Mackay—he was also Scottish and imbued with that distinctive Scottish passion for both wild and cultivated plants.

After four years in the College Botanic Gardens growing orchids and Cape heaths among many other things, David Moore became a field botanist working for the Ordnance Survey, collecting indigenous species in the north of Ireland. His contribution to Irish botany was to continue for many years. But in 1838 he returned to gardening as curator of the Royal Dublin Society's Botanic Gardens at Glasnevin.

David Moore took over a garden of about 30 acres which was in its fifth decade. It had been formed as a patriotic gesture in March 1795, had risen to be a fine garden and then declined into the doldrums. Ninian Niven—yet another Scot—was appointed to resuscitate it in 1834. He succeeded wonderfully and was able to bequeath to David Moore a vigorous and expanding collection. By the late 1830s plants were flooding in from collectors in the Himalaya and the Pampas of the Argentine, from Australia and the Cape of Good Hope. Glasnevin was already leading many of its sister gardens in the challenging work of plant introduction.

David Moore built on Niven's programme of replanting and acquisition. He began to form the orchid collection that was to sparkle brilliantly by the end of the century, and it was at Glasnevin, under David Moore's direction, that for the first time an orchid was raised from seed and brought into flower. He had an equal interest in trees and shrubs, raising and flowering such wonders as *Cardiocrinum giganteum*—a sumptuous lily from the Himalaya with a flower spike that can rise four metres in height.

Insectivorous plants were among David Moore's favourites and he evidently assembled a good collection of species. *Sarracenia* seeds were successfully germinated at Glasnevin, although from an exchange of letters printed in *The Gardeners' Chronicle* late in 1866, this evidently was not a general occurrence even in botanic gardens. Responding to a comment that seedlings 'do not appear to be common,'

Moore retorted:

> On two occasions seedlings of Sarracenias [*S. variolaris* = *S. minor*] have been raised at Glasnevin, first in the autumn of 1850 and again in the spring of 1851. I have however freely to confess, that I was not then aware of any particular interest being attached to the matter, thinking the same thing had been frequently done at other plant establishments, and consequently no further notice was taken of it, than that appertaining to the mere botanical question of the plants being exogenous or endogenous. Mr. D. Orr who sowed the seed and managed the young plants until they were distributed pretty freely in exchange for other plants, states that he sowed the seeds on the surface of rotted Sphagnum, which was placed in a common flat or pan for pots to stand in, and slightly covered them with a very thin dusting of propagating sand, covering all with an ordinary bell glass, at the outer edge of which he occasionally poured water, so as to keep the Sphagnum, within the glass constantly saturated.

But he was not content just to grow species: Moore and his gardeners, especially the young German-born propagator William Keit (see note 5), realised that by artificially cross-pollinating *Sarracenia* species, hybrids might be produced. This they did, raising a batch of seedlings from *S. drummondii* (correctly *S. leucophylla*), and from *S. rubra*, both of which had been pollinated with *S. flava*. The exact date of this work is not known but one document suggests the *S. leucophylla* × *flava* hybrid was created in 1870 and the other in 1872. The first hybrid acquired the name *Sarracenia* × *moorei* as a compliment to Dr Moore, and the second was named *S.* × *popei* after William Pope, a foreman in the Glasnevin Botanic Gardens.

Dr. David Moore brought the Glasnevin hybrids, and foliage of that wonderful aquatic lace-leaf, *Aponogeton madagascariensis* (formerly *Ouvirandra fenestralis*), to the International Botanical and Horticultural Congress, Firenze (Italy), in June 1874. For his achievements in raising the hybrids and growing the lace-leaf Moore was awarded two gold medals, both of which survive; one is in the National Museum of Ireland, Dublin (see note 1). Which medal was for which achievement is not known—they are identical.

By the late 1870s Glasnevin was a thriving garden, a veritable Mecca for plant enthusiasts—many Irish gardens benefited from the largesse of Glasnevin in distributing new and rare plants, and gardens, both public and private, in other countries were not omitted when new glories could be spared.

David Moore married three times. His first wife died of typhoid in 1836 leaving two young children who, it seems, went to foster-parents. David's second wife died in 1847, again leaving two children who were cared for by others. Margaret, his third wife survived him, and they had five children, the eldest boy being Frederick who also became a brilliant horticulturist. When David Moore died in June 1879, Frederick was quickly appointed to succeed him as curator in Glasnevin. Following his father's successful crosses, Frederick Moore continued to raise *Sarracenia* hybrids, including back-crosses (see Table 1) during the 1880s and 1890s.

David Moore—born on 23 April 1808 at Dundee, Scotland (see note 6), died on 9 June 1879 in Dublin—is commemorated in the names of several other plants, for example, *Equisetum* × *moorei*, *Salix* × *moorei*, *Apium* × *moorei* (three natural hybrids found in Ireland), *Crinum moorei* (the lily from Natal, depicted in the stamp series) and *Passiflora mooreana* (a passion flower from Argentina). *Moorea* was proposed as the generic name for the Argentinian pampas grass but was never taken up and *Cortaderia* is now conserved against it.

Table 1: Hybrids created in Glasnevin 1870-1885: this is an exact transcription of a list made c. 1900 by Frederick Moore (nomenclature has not been updated, nor has the orthography of the names been altered, although neither accords with present-day rules of nomenclature).

1870 *S. Moorei* = (*S. Drummondi* × *S. flava* ♀)
1872 *S. Popei* = (*S. rubra* × *S. flava* ♀)
1878 *S. Drummondi* × *S. flava* ♀ 3 pots
1879 *S. flava* × *S. purpurea* ♀
1880 *S. Popei* with sps ? [i.e. sp. ined]
S. Popei × *S. purpurea* ♀
S. Moorei × *S. purpurea* ♀
S. Drummondi alba × *S. Moorei*
S. flava × *S. Drummondi* ♀
S. flava × *S. purpurea* ♀
S. Drummondi × *S. purpurea*

1881 *S. Drummondi* × *S. Chelsoni* [second parent is male]
S. Drummondi alba × *S. Chelsoni*
S. flava × *S. Drummondi*
S. rubra × *S. Chelsoni*
S. Chelsoni × *S. Drummondi*
S. Moorei × *S. purpurea*
S. flava × *S. purpurea*
S. popei × *S. Chelsoni*
S. Drummondi × *S. Chelsoni*
S. flava × male parent uncertain (self ?)
S. purpurea × *S. Chelsoni*
S. rubra × *S. purpurea*
S. flava × *S. Chelsoni*

1882 *S. Popei* × *S. purpurea* [ditto]
S. flava × *S. purpurea*
S. Moorei × *S. purpurea*

1883 *S. flava* × *S. Stevensii* [ditto]
S. Popei with flowers and pitchers closely approaching *S. flava* × *S. Stevensii*
S. Stevensii × *S. flava*
S. Moorei × *S. Stevensii*
S. Moorei × *S. purpurea* [ditto]
S. Drummondi × *S. Chelsoni*
S. Popei × *S. Chelsoni*
S. Popei × *S. Chelsoni*
S. Popei × *S. purpurea*
S. rubra × *S. purpurea*
S. flava × *S. purpurea*
S. purpurea × *S. flava*
S. purpurea × *S. Moorei*
S. Chelsoni × *S. Popei*

1884 *S. Chelsoni* × *S. Patersoni*
S. Williamsii × *S. Moorei*
S. Stevensii × *S. Moorei*
S. flava maxima × *S. Moorei*
S. purpurea × *S. flava maxima*
S. Chelsoni × *S. flava maxima*
S. Moorei × *S. Chelsoni*
S. Popei × *S. Williamsii*
S. flava maxima × *S. purpurea*
S. Stevensii × *S. purpurea*
S. rubra acuminata × *S. purpurea*

1885 *S. Chelsoni* × *S. rubra acuminata*
S. purpurea × [*S. rubra acuminata*]
S. Moorei × *S. Patersoni*
S. rubra acuminata × *S. Patersoni*
S. Patersoni × *S. Chelsoni*
S. rubra acuminata × *S. Madissoniana*
S. Drummondi × [*S. Madissoniana*]

Notes

1. For a comprehensive history, see Nelson, E.C. and McCracken, E.M. 1987, The Brightest Jewel: a History of the National Botanic Gardens, Glasnevin, Dublin, Boethius Press, Kilkenny.
2. This nomenclatural quagmire is discussed fully in Nelson, E.C. 1986, *Sarracenia* Hybrids Raised at Glasnevin Botanic Gardens, Ireland: Nomenclature and Typification, Taxon 35: 574-578.
3. Not after Thomas Moore of Chelsea Physic Garden, as was stated by Mazrimas, J.A. and Song Jr., L.C. 1984, *Sarracenia* Hybrids—The F-1 Generation. Part I. *S. flava* Hybrids, Carniv. Pl. Newslett., 13, 41-44.
4. Nelson, E.C. 1987, The Scottish Connexion in Irish Botany and Horticulture, Scottish Naturalist, 1987: 3-31.
5. McCracken, E.M. and Nelson, E.C. 1989, Julius Wilhelm Keit, A German Horticulturist At the Botanic Gardens, Glasnevin, Moorea, 8, 34-40.
6. Various sources state that his surname was originally Muir: his baptismal gives it as Moir which is another variant of Moore. For date of birth see Nelson, E.C. 1983, David Moore's Date of Birth—A Correction, Glasra, 7, 24.
7. The modern names for the species and hybrids mentioned in this article and

accompanying table are as follows: *S. Chelsoni* = *S.* × *chelsonii* (i.e. *S. rubra* × *purpurea*), *S. Drummondii* = *S. leucophylla*, *S. Maddisoniana* = *S.* × *formosa* (i.e. *S. psittacina* × *minor*), *S. Moorei* = *S.* × *moorei* (i.e. *S. leucophylla* × *flava*), *S. Popei* = *S.* × *popei* (i.e. *S. rubra* × *flava*), *S. rubra acuminata* = *S. rubra* subsp. *rubra*, *S. Stevensii* = *S.* × *catesbaei* (i.e. *S. flava* × *purpurea*), *S. Williamsii* = *S.* × *catesbaei* (i.e. *S. flava* × *purpurea*). The references to "*S. patersoni*" in the list written *ca.* 1900 present interesting problems since apparently such crosses did not exist in or before 1884. (Note #7 supplied by the editors.)

Cultivation of *Triphyophyllum peltatum* (Dioncophyllaceae), the Part-Time Carnivorous Plant

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Summary

Cultivation of *Triphyophyllum peltatum*, a rarely grown part-time carnivorous plant, is presented.

Introduction

Comparatively little is published on *Triphyophyllum peltatum* (Hutch. & Dalz.) Airy Shaw, a liana widely neglected among carnivorous plant students and growers. Almost nothing has been published on the cultivation of this plant. In the course of our investigations of the secondary metabolites of the plant order Nepenthales, especially of the naphthylisoquinoline alkaloids (Bringmann & Pokorny 1995[1]) that are so far known only from two small palaeotropical families, *viz.* Ancistrocladaceae and Dioncophyllaceae, we became interested in the physiology and biochemistry of these plants. Live material is indispensable for the study of the biosynthesis of the plant natural products. Therefore, efforts were made to obtain living specimens of several species of *Ancistrocladus* (the only genus of Ancistrocladaceae) and of *Triphyophyllum peltatum* (one of three monotypic genera of Dioncophyllaceae, and the only carnivorous plant to contain naphthylisoquinolines, Bringmann *et al.* 1998a). We succeeded in finding seeds and small plants of a number of these species, including *T. peltatum*. Our experience with germination and cultivation, including *in vitro* methods, are communicated in this paper.

[1]Part 124 in the series "Acetogenic Isoquinoline Alkaloids". For part 123, see Bringmann *et al.* 1998c.

T. peltatum is a high forest liana that grows in coastal rain forests of tropical West Africa (Airy Shaw 1952). *Triphyophyllum* means "three kinds of leaves," which characterizes this particular genus. During most of its life cycle it is not a carnivorous plant. In its juvenile phase it forms rosettes of undivided lanceolate leaves with obtuse to acute leaf tips. Once the young plant attains a certain age and height (ca. 25-40 cm), on the onset of the next rainy season, carnivorous leaves are formed that have a more or less reduced lamina and a prolonged midrib beset with glandular emergences (Figure 5, p9). These glands secrete a sticky mucilage (Marburger 1979) and capture invertebrates (Green *et al.* 1979). The uptake of the amino acid L-alanine by the carnivorous leaves of *T. peltatum* has been demonstrated recently (Bringmann *et al.* 1998b). Later on, the plant climbs rapidly into the canopy of high trees, attaching to supporting plants by leaves that have two hooks curling towards the leaf base at either side of the leaf tip (Dioncophyllaceae means "plant family with double-hooked leaves"). While the white or pale pink flowers are not spectacular, the seeds are unique within the plant kingdom. Unlike most angiosperm fruits, those of Dioncophyllaceae open prior to seed maturity. These plants have, therefore, been called "secondary gymnosperms" although they are far from being related to the conifers. The large (5-12 cm across), disk-shaped seeds are borne on prolonged, thickened and even woody funiculi (seed stalks) attached to the centre of the disks. The embryo is located close to the point of attachment in a thickened ring of white endosperm approximately 1 cm in diameter (Figure 1), the rest of the seed consists of a thin, papery wing that is slightly striated radially (Figure 2). The detached seeds are able to fly for considerable distances until they reach the floor of the rainforest.

Figure 1: Cross-section of ripe seed of *T. peltatum* with removed wing. (Photo: H. Rischer)

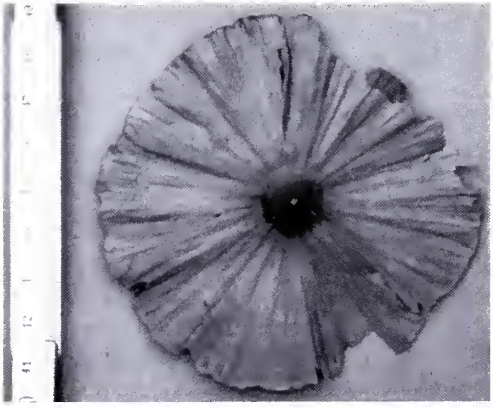

Figure 2: Ripe seed of *T. peltatum*. (Photo: H. Rischer)

Habitat

Being a West African endemic, *T. peltatum* grows in the Ivorio-Liberian block of the Western forest massif. It is quite frequently found in the Taï National Park, which belongs to the Guineo-Congolese domain. The dense humid evergreen forest is classified as a "*Eremospatha macrocarpa* and *Diospyros mannii* forest," a fundamental type determined by climatic and soil conditions (Guillaumet & Adjanohoun 1971). The component tree species (like *Eremospatha macrocarpa* (Mann &

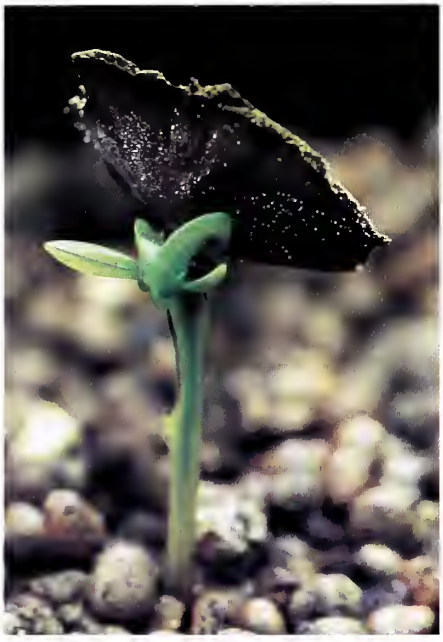

Figure 3: Seedling of *T. peltatum* just after germination. (Photo: H. Bringmann)

Figure 4: Same plant as in Figure 3 a few days later with shed seed coat. (Photo: H. Bringmann)

Figure 5: Carnivorous specimen of *T. peltatum* at Centre National de Floristique, Abidjan, Ivory Coast. (Photo: H. Bringmann)

Wendl.) Wendl., *Diospyros mannii* Hiern, *Diospyros gabunensis* Gürke, *Maranthes chrysophylla* (Oliv.) Prance, *Chrysophyllum perpulchrum* Mildbr. ex Hutch. & Dalz., *Chidlowia sanguinea* Hoyle, etc.) are found in other communities, but in lower abundances. The lowland community is a "*Diospyros spp.* and *Mapania spp.* forest," as typified by *Mapania* (Cyperaceae) and *Tarrietia utilis* (Sprague) Sprague (Sterculiaceae) growing in clay soils.

Above all, the vegetation of the South West of Ivory Coast is marked by the specific endemism of the flora containing particular taxa called "Sassandrians," a term used to describe the species that occur in the shady forests in the West of Ivory Coast between the rivers Sassandra and Cavally. Independent from the presence of *T. peltatum*, this particular flora contains the following species: *Androsiphonia adenostegia* Stapf (Passifloraceae), *Cassipourea hiotou* Aubrév. & Pellegr. (Rhizophoraceae), *Cola buntingii* Bak. f. (Sterculiaceae), *Crinum scillifolium* A. Chev. (Amaryllidaceae), *Gilbertiodendron robynsianum* Aubrév. & Pellegr. (Caesalpiniaceae), *Guarea leonensis* Hutch. & Dalz. (Meliaceae), *Hypolytrum schnellianum* Lorougnon (Cyperaceae), *Ouratea amplectens* (Stapf) Engl. (Ochnaceae), *Sciaphila africana* A. Chev. (Triuridaceae), *Soyauxia grandifolia* Gilg & Stapf (Medusandraceae), *Thomandersia anachoreta* Heine (Acanthaceae), etc. In Sierra Leone and Liberia, *T. peltatum* exists under the same ecological conditions.

Cultivation of *T. peltatum* in the Greenhouse

We received uprooted, juvenile but post-carnivorous *T. peltatum* specimens. In Würzburg, these were planted in fine grain, #2 Lecaton® (from Leca, Pinneberg, Germany) substrate in pots 10 cm wide and 20 cm tall. This substrate does not rot under greenhouse conditions. The high pots provide enough depth for the roots to descend a considerable distance into the substrate. Although they suffered from desiccation when the greenhouse door was left open, they grew well for a few years, and produced long shoots with hooked leaves, some of which were several meters long with short shoots that bore normal leaves sprouting from the axils of the hooked leaves. Eventually, however, they all died. Examination of the roots showed that no growth below ground had ever taken place after the plants were uprooted and transported. Similar plants grown in shaded greenhouses in Abidjan showed new root growth after 3 to 6 months, with an average survival rate of 40 to 50%. Especially when the plants are grown in the temperate zone, the sensitive root system should not be disturbed once the plants have been established. This means that there are only two ways to obtain normally growing plants, *viz.* by seed or by growing rooted plants without removal of the substrate.

Seed is extremely difficult to obtain because it is set during the rainy season, when traveling to the localities of *T. peltatum* is very troublesome. Furthermore, to harvest seed one must climb high trees since seeds detached by the wind will fly and disappear into the dense ground vegetation. Thus, it took more than ten years before one of us (L.A.A.) finally reached fruiting plants in May 1997. The seeds were sown immediately in Abidjan and in Würzburg under greenhouse conditions. In Abidjan the seeds were planted *ca.* 3 cm deep in sandy potting soil and watered frequently. The germination rate was ca. 80%. In Würzburg, flat dishes were used with a 2 cm layer of Lecaton®, which was kept permanently wet by a constant water level of 1 cm below the surface of the substrate (maintained by a drainage hole at one side of the dish). The wings of the seeds were removed in order to prevent excessive fungal/algal proliferation, and the seeds were sown on the surface of the substrate. The dishes were kept in a light place without direct sunlight at 22°C and almost 100% humidity. Germination (*ca.* 50%) took place after a few weeks to several months. The cotyledon tips remained in the seed coat in intimate contact with

the endosperm (cryptocotylar germination). The hypocotyl and root pushed their way out of the seed at the former point of attachment of the funiculus. These observations correspond to those by Schmid (1964) with *Habropetalum dawei*, the only other member of Dioncophyllaceae hitherto reported to have been germinated and grown for several months outside Africa. The growing hypocotyl then lifted the seed up and the cotyledons bent sidewards at their base. The primary leaves sprouted from a narrow slit between the cotyledons where they were attached to the hypocotyl (Figures 3 and 4). These were the first rosette leaves. The rosettes produced leaf after leaf and grew in length without an obvious correlation to the changing (outdoor) seasons of temperate climate. Light intensity was kept constant by artificial lighting (between 8 h and 20 h) so that a mean light sum of 340 klx h was reached daily. Some of the rosette leaves reached a length of more than 30 cm. A one-year old plant with 20 cm long leaves was displayed at the Second Conference of the ICPS in Bonn at the end of May 1998.

In addition, rooted plants of *T. peltatum* in their substrate were sent to Würzburg in summer 1997. These plants recovered remarkably well from the transport and are still alive. Both the germinated specimens and the plants sent with roots are now being acclimatized to normal warmhouse conditions (average 22°C, occasional minimum of 17°C at about 7 a.m. maximum of 28°C at 6 p.m., average 83% humidity, occasional minimum 53%, maximum 95%, *cf.* typical plots on Figure 6) because excessive humidity led to algal growth on the leaves and favoured other pests, especially aphids and scale. Larvae of fungus gnats, which are favoured by the required high temperatures and intense watering and which cause severe damage especially on the sensitive roots of young plants, are controlled by continuous treatment with predator nematodes (Nemalogic®, from Sautter & Stepper, Ammerbuch, Germany). The plants are still growing (see Front Cover), and some have attained a size that corresponds to carnivorous specimens in the wild. We

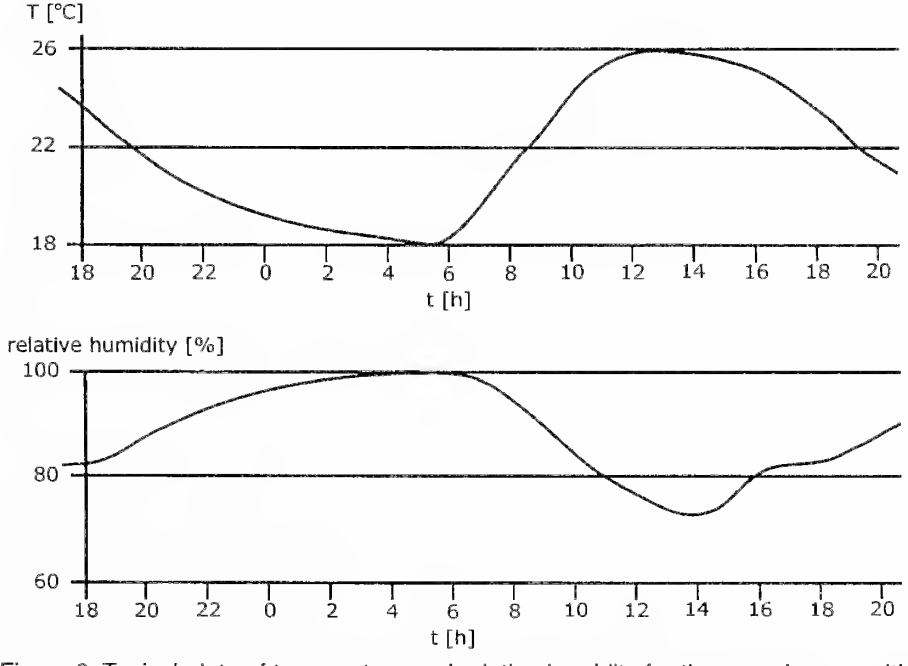

Figure 6: Typical plots of temperature and relative humidity for the greenhouse cultivation of *T. peltatum* at the Botanical Garden of Würzburg.

have, however, not yet obtained carnivorous leaves. Less than 5% of the seedlings have died. This is the first successful germination of seeds of *T. peltatum* achieved in cultivation.

in vitro Cultivation of *T. peltatum*

Axenic *in vitro* cultivation of plant material facilitates both the propagation of the plants and the investigation of their physiology. There are apparently no reports in the literature on the tissue culture of *T. peltatum* or any other member of Dioncophyllaceae. We sowed some of our seeds in sterile conditions because greenhouse-grown plant material is difficult to surface-sterilize. The lack of experience with the sterilization of these seeds and the unique occasion of having viable material encouraged us to try several simultaneous approaches. The wings were removed, and the remaining centres were surface-sterilized using 70% ethanol for ten seconds and a sodium hypochlorite solution (13% free chlorine) with one drop of detergent (Triton X-100, from Serva) for 30 minutes followed by three rinses with sterile, distilled water. For some of the seeds we tried to uncover the embryo but the very brittle endosperm and the fragile nature of the embryo complicated this endeavour. The best results with respect to sterility and germination rate were obtained with removal of only the external layers of the seed coat so the white endosperm was not affected. Half of each batch was sown on a different medium. One medium was full-strength Murashige & Skoog medium (1962) supplemented with 3% sucrose and 0.2% Gelrite® and the other one was Seramis® (Effem, Verden/Aller) soaked with MS medium containing 3% sucrose. The media were adjusted to pH 5.8 and filled in 100ml Erlenmeyer flasks. These were autoclaved for 30 minutes at 120°C and 120kPa.

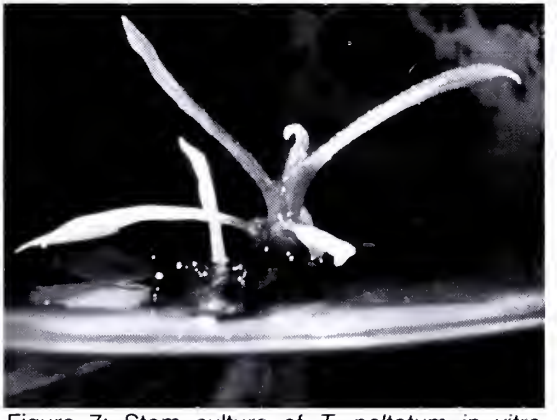

Figure 7: Stem culture of *T. peltatum in vitro*, Institute of Organic Chemistry, University of Würzburg. (Photo: H. Rischer)

Germination occurred within three months though the overall percentage was very low (10%). Neither the free embryos nor seeds sown on MS media solidified with Gelrite® germinated. The cryptocotylar germination (see above) was clearly observed *in vitro*. When the plantlets were about 5 cm high their growth slowed. We conclude that the plantlets were not sufficiently supplied with nutrients on the Seramis substrate. The stems were therefore cut above the cotyledons, and the apical parts were aseptically transferred to flasks containing one-fifth strength MS media solidified with 0.2% Gelrite® and containing 3% sucrose. On this medium the plants grew exceptionally well when transplanted monthly to fresh medium (Figure 7). If the plants are not transplanted in this way, they will not grow well.

Currently we are trying to obtain callus cultures, *i.e.* completely undifferentiated cells using different organs of the specimens as explants. It is hoped that these cultures will grow faster and produce the typical naphthylisoquinoline alkaloids as well as their biosynthetic precursors.

Acknowledgements

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NOTES ON *NEPENTHES* FROM NORTHERN SUMATRA

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Keywords: new taxa: *Nepenthes angasanensis.*

Summary

A previously unrecognized species of *Nepenthes* (Nepenthaceae) from Puncak Angasan, Aceh Province, Sumatra, Indonesia is described and illustrated. The original description of *N. mikei* is reinstated.

Introduction

On a recent field trip to Sumatra (Sept. 1997) a party of four people, three from New Zealand (Ricky Maulder, Bruce Salmon, Brian Quinn) and one from Australia (Dale Schubert), rediscovered a species that we regarded to require a formal description. We took guides from the town of Blangkejeren and on to Penosan where we began the climb at about 1600m. This species first appeared on Puncak Angasan (en-route G. Leuser) at 2400m and continued on up to 2600m where a recent fire had destroyed the higher forest. It is named by Dale Schubert.

General

At first glance this species bears a striking resemblance to *N. tobaica*. However upon further examination it became apparent to us that this species is not *N. tobaica* and that it required its own specific name. Several clues initially attracted our attention, leading us to believe that we were dealing with something new (see Table 1). At first glance this species appears similar to *N. tobaica*. However, combined with the above geographical and ecological observations, and the main morphological differences noted in Table 2, we believe that we are justified in the naming of a new species. Van Steenis[1] collections from the same area (Puncak Angasan, G. Kemiri, G. Lembuh) that were placed into *N. tobaica* by Danser (1940) are also likely to be this species. This new species also has a slight resemblance to *N. mikei* but mainly in rosette leaf shape/attachment and inflorescence structure. *N. mikei* is not a very variable species, at least between specimens from G. Pangulubau[2] and G. Bandahara. Even new herbarium material, recently collected from the type location, falls within the margins of the original description. (The original description was based on cultivated specimens.) We have not observed the characteristics in this species which are used by Jebb & Cheek[1] (1997) in their emended description of *N. mikei*. For this reason, we believe that Jebb & Cheek included other species in constructing their emended description. We feel that the orginal description should be reinstated until further studies can be performed.

[1]As we have not viewed the van Steenis nor the "Jebb & Cheek" herbarium material we are unable to confirm our suspicions at this time.
[2]Jebb & Cheek state that G. Pangulubau is in Riau Province when in fact it is in the Province of North Sumatra.

Table 1

	N. tobaica	*N. angasanensis*
Location	North Sumatra, principally the Lake Toba area.	Aceh, possibly known from only three mountains.
Altitudinal range	800-1500m.	2300-2800m.
Habitat	Growing in clay and volcanic soils in open scrub - *Leptospermum* sp.	Growing in moss and leaf litter in mossy forest.

The new species from Puncuk Angasan is formally described in the following text.

Nepenthes angasanensis Maulder R., Schubert D., Salmon B., Quinn B., *spec. nov.*

N. tobaica Danser similis sed ascidia radicalia longiora 120-150mm longa, calcar bis vel ter ramosum (non fasciculatum). Inflorescentia feminea, pedicellis unifloris, brevibus 55-125mm longa.

Holotypus: B. Salmon and R. Maulder (234372), Young plant with pitchers, leaf and pitcher from short shoot, female inflorescence, fruits. Sumatra, Aceh Province, G. Puncak Angasan, Slopes above Penosan, 2500m alt. 25 Sept. 1997 (AK).

Stems; climbing up to 9m high, cylindrical, 2-4mm broad. Scattered short shoots arise from underground rhizomes. Internodes, 20-60mm long. Leaves of the rosettes; coriaceous, sessile, linear, 50-70mm long, 10-13mm broad, acute at the apex, tapering gradually towards and abruptly contracted at the base, clasping the stem for 2/3 the diameter. Pennate veins; irregularly reticulate running obliquely to the margin. Longitudinal veins; 2-3 on each side running in the outer 1/3 of the blade, most originating from the midrib near the base and sometimes from up to 1/2 way along the blade, converging at the tip. Tendrils; slender, 1-1.5mm broad approximately 2/3 to the same length as the leaf, descending without curl. Leaves of the short shoots; similar to those of the rosette but larger, 100-200mm long, 12-25mm broad with 3-4 longitudinal veins running the length of the blade. Leaves of the climbing stem; similar to those of the rosette and short shoots, perpendicularly attached to the stem, lanceolate, obtuse/acuminate at the tip, 100-120mm long, 20-25mm broad. Tendrils; bearing pitchers with a single or double curl. Pitchers of the rosettes; abruptly incurved at the front from the hanging end of the tendril. Pitchers facing the centre of the rosette, 60-80mm long, 18-20mm broad. Narrowest from the front, ovate in the lower 1/2, ventricose in the middle, tubular to slightly infundibuliform in the upper 1/2, narrowing slightly towards the mouth with two fringed wings running the entire length. Wings; 1-1.5mm broad, fringe segments filiform, 3-6mm long and 8-12 fringe segments cm^{-2}. Mouth; oblique, elevated towards the lid. Shape ovate becoming acuminate towards the lid with almost no neck. Peristome; rounded, 1-1.5mm broad in front, 3-4mm broad near the lid. Ribs; 0.4-0.5mm apart, 1.5-2mm long on the inner margin. Inner surface of the pitcher; glandular in the lower 1/2 with minute overarched glands. Glands; evenly distributed, rotund, 0.2-0.3mm long and 300 cm^{-2}. Glands becoming larger towards the bottom with upper 1/2 glandless and pruinose. Pitcher lid; ovate, cordate at the bottom, rounded at the top. The lower surface glandular with a few scattered minute rotund and rimmed glands, the long axis of the glands being oriented parallel with the long axis of the lid, midrib almost nonexistant. Spur; forked, 0.3-0.4mm long inserted at the base of the lid. Pitchers of the short shoots; similar to those of the rosette but larger, abruptly incurved at the side from the hanging end of the tendril, facing outwards from the stem, 120-150mm long, 30-40mm broad. Lid; 30-35mm long, 25-28mm broad, glands; few, concentrated along the midrib and scattered around the edge, 0.2mm long. Wings reduced to ribs. Spur; singular, sometimes branched, 6-7mm long. Pitchers of the climbing stem; similar to those of the rosette but often very bulbous in the lower 1/3, abrupt-

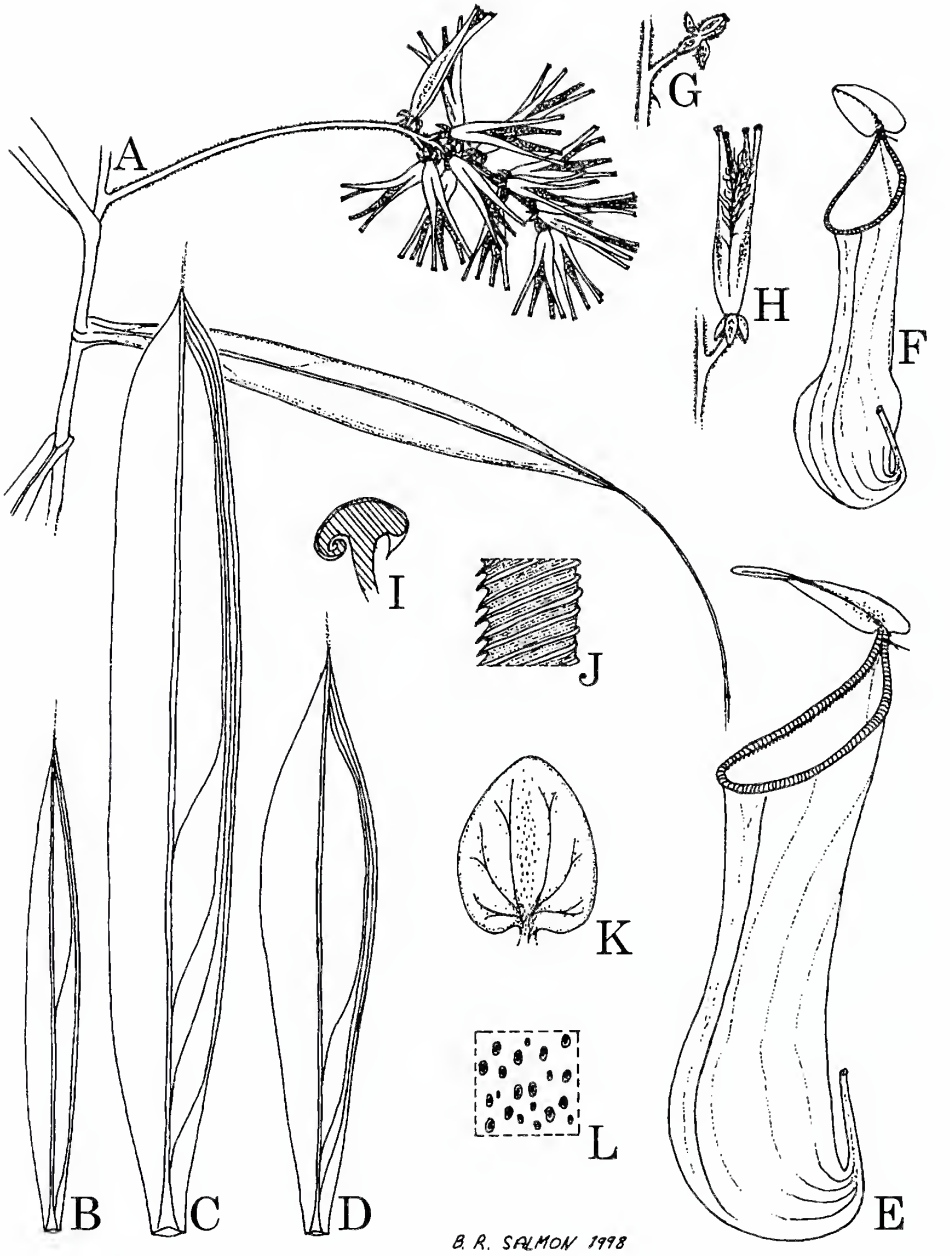

Figure 1: *N. angasanensis*: A)stem with female inflorescence × 1, B)Lower leaf (rosette) × 1, C)Intermediate leaf (short shoots) × 1, D)Upper leaf (climbing stems) × 1, E)Intermediate pitcher × 1, F)Upper pitcher × 1, G)Female flower × 1.5, H)Ripe fruit × 1.5, I)Peristome cross-section × 10, J)Detail of peristome viewed from above × 10, K)Lid (underside) × 1, L)Detail of glands on underside of lid × 10.

ly incurved at the back from the hanging end of the tendril, 80-90mm long, 18-25mm broad. Lid; 18-22mm long, 15-20mm broad. Lid glands; 0.1mm long, sparse, concentrated at the midrib and scattered over the surface. Wings; reduced to ribs. Spur; single or branched, 3-4mm long. Male inflorescence unknown. Female inflorescence; a raceme. Peduncle; cylindrical, 40-90mm long, 1.2-2mm broad. Axis; gradually tapering towards the tip, 15-35mm long bearing 9-17 flowers. Pedicels; situated in a whorl, 1-flowered sometimes with a 1-1.5mm long bracteole near the base of the lowest flower, 5-20mm long; interpedicel length 2-9mm; pedicel bases, 0.5-1mm broad, 3mm long near the top of the axis, 9mm long near the bottom. Tepals; lanceolate, cupped, 4-5mm long, 1.5mm broad, reflexed; inner surface glandular, glands, elliptic, rimmed, 0.1-0.2mm long, the long axis of the glands being orientated parallel with the long axis of the tepal. Carpels; 5-7mm long, 2-3mm broad being shortest near the top of the axis. Fruit valves; 20-27mm long, 3-4mm broad. Indumentum; very sparse on mature parts, the stems and leaves, including their axils, glabrous. Tendrils covered with filiform hairs, 0.2-0.5mm long. Pitchers and lid sparsely covered with filiform hairs, 0.3-0.5mm long. Peduncle, pedicels and ovary densely covered with short filiform adpressed hairs, 0.3mm long. Outer surface of tepals also with a few of these hairs. Edges of tepals densely tomentose, hairs filiform, curled, 0.05-0.1mm long.

Table 2

Comparisons between *N. angasanensis* and its nearest relatives, *N. tobaica* and *N. mikei*

	N. tobaica	***N. angasanensis***	***N. mikei***
Habit	No rhizomes.	Produces offshoots from underground rhizomes.	No rhizomes.
Spur	Filiform.	Forked.	Fasciculate.
Inner margin of Peristome	Teeth < 0.2mm.	Teeth to 1.5-2mm long.	Teeth to 0.2-0.4mm long.
Stem cross section	Cylindrical to obtusely triangular.	Cylindrical.	Cylindrical.
Bracteoles	At base or slightly below pedicel attachment. Few.	Sometimes near base of lowest pedicel only.	Half way up every pedicel.
Pitcher glands	200-250 / cm^2.	300 / cm^2.	150-180 / cm^2.
Pedicels	2-flowered.	1-flowered.	1-flowered.
Inflorescence (female)	195-400mm long, 30-50 flowers.	55-125mm long, 9-17 flowers.	40-80mm long, 4-10 flowers.

Colour

Herbarium specimens; Brown to blackish. Living specimens; Stems; dark red to black. Leaves; glossy green above lighter below. Midrib; light green. Tendrils; green, turning pitcher colour towards the tips. Pitchers; red to black sometimes green or flecked with red outside, whitish green or reddish inside. Lid; like that of the pitcher. Peristome; green, sometimes red or black. Inflorescence; dark green/grey. Indumentum; white, tepal edge hairs brown.

Distribution

Indonesia, Aceh province, Puncuk Angasan, slopes above Penosan, 2400-2600m.

Ecology

Open, montane, mossy forest among trees reaching 12m high. Forming a few hybrids with *N. densiflora* where their ranges overlap.

Derivation

The specific epithet *angasanensis* refers to the mountain from which the type specimen originates.

Specimens Examined

N. angasanensis: B. Salmon & R. Maulder, 234372 (Holotype), Young plant with pitchers, leaf and pitcher from short shoot, female inflorescence, fruits. Sumatra, Aceh Province, G. Puncak Angasan, Slopes above Penosan, 2500m alt. 25 Sept. 1997 (AK). Duplicates sent to (K), (BO).

Acknowledgements

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Turion Overwintering Of Aquatic Carnivorous Plants

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Keywords: ecology: *Aldrovanda vesiculosa*, *Utricularia*.

Introduction

Overwintering buds (turions; Latin *turio*=shoot) are vegetative dormant organs produced by perennial aquatic plants. Turions are formed in subtropical to polar zones as a response to unfavorable ecological conditions, and protect fragile plant shoots from freezing and decaying. Turions are modified shoot apices. Both morphologically and physiologically, turions of free-floating aquatic plants, and especially of *Utricularia* and *Aldrovanda*, are the most modified ones of all. During the winter they separate from the mother shoot, which totally decays afterwards.

Turions of aquatic carnivorous plants are more or less spherical, sturdy organs 1-20 mm in size, and form by the extreme condensation of very short modified leaves in the shoot apex at the end of the growing season (Figure 1). Their leaves bear only rudimentary traps. Turions are frost resistant, but their main ecological function is to sink to warmer water. At the end of winter they rise to the water surface where they sprout in warmer water. They also behave as propagules and are spread by waterways or water birds.

Initiation and Ripening of Turions

In central Europe, turions formation is preceded by the production of distinctly shortened internodes in late August. The turions are usually formed in September after the growth rate of shoot apices reduces. Cooler and shorter days induce turion formation. N or P deficiency in water apparently does not have the influence on turion formation of aquatic carnivorous plants that it does on duckweeds. The rela-

Figure 1: *Aldrovanda vesiculosa* turions stored in refrigerator over winter, late April 1997.

tive importance of temperature decrease and short days probably differs in different species. In *U. vulgaris* in Canada (52°N), turions begin to form as early as August as a result of cooling waters and shortening day length.

In thermophilous *Aldrovanda*, low water temperature is crucial and decreasing light might be an important effect, but the effect of short days is negligible. Turions formed about three weeks later (at the end of September) in *Aldrovanda* grown in a relatively warm outdoor culture at Trebon (49°N, Czech Republic) than in plants introduced to colder shallow waters in the Trebon region (early September). At the northernmost site at Lake Ladoga in northern Russia (61.5°N), they form as early as in mid-August and ripen in early September. In October, *Aldrovanda* also formed normal turions in a heated greenhouse where water temperature never fell below 18°C. When grown from turions in an aquarium on a window ledge in a heated room, normal turions were also formed in March-May, i.e. under the conditions of long (and increasing) day length. These plants formed turions in late May after they were transferred outdoors to colder water. Reports from J. A. Mazrimas growing the Japanese subtropical *Aldrovanda* indicate turion formation to be initiated at 16°C; however, it is not clear whether this is the day, night, or average temperature. Apparently, turion formation in *Aldrovanda* occurs after a long-term marked relative temperature fall (e.g. from 30 to 20°C), and not after reaching some low threshold temperature.

While the formation of turions may occur at 18-20°C, full physiological turion maturation requires lower temperatures (at least 8-10°C), lessening light, and possibly also short days. Turion maturation is accompanied by the translocation of the majority of N, P, and storage organic substances (sugars) from the dying mother shoots. As turions mature, they become more compact and contain more storage substances. In the absence of low temperatures, evergreen shoots do not decay over the winter season but remain firmly connected to the turions.

The development of turions is also controlled by humic acids. In *Aldrovanda*, humic acids in water accelerate the formation, maturation, and sinking of turions. In spring, humic acids mildly inhibit turions from rising to the water surface to sprout (by altering their buoyancy); humic acids also enhance the growth of already germinated turions. Humic acids (and maybe also tannins) thus play an important role as exogenous phytohormones leading to optimal seasonal *Aldrovanda* development.

Sinking of Turions

It is interesting that turions of seven similar European aquatic carnivorous plant species have three different strategies of autumnal sinking and spring floating. In two strategies, sinking and floating are passive and are not directly controlled by turions.

a) *U. australis, U. vulgaris, U. intermedia,* and *U. ochroleuca*: in this group, ripe turions are always less dense than water and are firmly connected to the mother shoots. As the mother shoots gradually decompose, they become denser than water and drag the turions to the bottom. By early spring, the turions separate and float to the surface. The turions can reach the water surface as soon as the ice cover has melted.

b) *U. minor* and *U. bremii*: turions start forming in late August with an unusual structure in the shoot apices (Figure 2, p21). Antler-like branched leaves form a basket (1-2 cm across) enclosing the developing turion. In late September and October, light ochre-colored mother shoots die and drag the turions to the bottom. In autumn the turions break free, but remain entangled in the apical baskets. They float to the surface only after the baskets decompose.

Figure 2: *Utricularia bremii* from outdoor culture, late October 1997. Turions are surrounded by baskets of apical leaves. Drawn from herbarium specimens by E.M. Salvia.

c) *A. vesiculosa*: in this species, a remarkably active way of sinking and rising has developed. In autumn ripe turions break off the dying mother shoots at the water surface. After a few days, they sink gradually to the bottom. Their high density is not only caused by their high starch content but also, presumably, by their expulsion of excess gases. In time, the turions are slightly obscured in the sediments. In April-May, they respond to the warming water, and within a few days rise to the surface.

Composition and Resistance of Turions

Turions of aquatic carnivorous plants are storage organs. While the dry weight (DW) of summer shoots is only 8-12% of the fresh weight, it is 25-46% of the fresh weight in autumn. The high proportion of DW in autumn is caused by the accumulation of starch (25-32% DW) and free sugars (glucose, fructose, sucrose; in total 7-14% DW). Stores of N are in the form of amino acids (arginine, lysine). Over winter, the metabolism of turions is very low and probably anaerobic. Their respiration rates at 4-5°C are about one order of magnitude lower than those of summer shoots at 20°C. Yet, the total content of saccharide energy sources in turions gradually decreases to 15-24% DW over winter. In this way, the DW proportion also decreases to about 18-20%. The spring starch content is rather low (about 8-11% DW) but the free-sugar content is increased (7-16% DW).

Ripe turions of aquatic carnivorous plants are frost-resistant. Ripe *Aldrovanda* turions do not survive storing at -10°C in water or -12°C in humid air. When they are overwintered in the wet bottom of a drained tray (our winters are moist so such exposed turions do not dessicate) or in the field where they are gradually adapted to frosts, they fully survive frosts of -10 to -15°C. *Aldrovanda* turions survive -4°C for long period. *U. vulgaris* turions exhibit an increasing resistance to -8°C in the course of winter but they do not survive -12°C (similar behavior has been observed in *U. australis* turions). However, their frost-resistance is very low when they are germinating. The high resistance of turions to weak frosts of -2 to -4°C could be used to store them for several years, since turions survive for only about 10-12 months when stored at 3-5°C. This suggests turions at natural sites might only survive from one season to the next one, not longer.

Turions are drought-resistant. In *U. vulgaris* and *Aldrovanda*, turion-like organs are also formed as a result of summer drought. They are not dormant, and in water, they resume their growth again.

Turions usually overwinter under unfavorable conditions of anoxia, a strongly reduced medium (i.e. low redox potential), and in the presence of toxic substances (e.g. H_2S or acetic acid). Ripe turions of aquatic carnivorous plants are able to tolerate these unfavorable conditions even though experimental evidence for this is still lacking. In the spring, their tolerance of these conditions decreases.

Dormancy States and Their Hormonal Regulation

After turion formation, two dormancy states can be distinguished. They are controlled by endogenous levels of stimulating and inhibiting phytohormones. The dormancy states (and their hormonal patterns) have been described in detail for Canadian *U. vulgaris*. Turions enter a state of innate dormancy at the end of August, when their growth is blocked by endogenous factors in the turions (even though external ecological conditions are still favorable to growth). During innate dormancy, aging and dying of mother shoots (and their sinking to the bottom) occurred. High levels of abscisic acid (the inhibitory phytohormone) and low levels of free gibberellins, auxin, and cytokinins, occur in this dormancy state. Abscisic acid has the principal influence, as it induces turion formation. High temperatures (30°C) can temporarily break innate dormancy, but is followed by the formation of turions again. Innate dormancy was only broken by the combination of short days and low temperatures. In field collected *U. vulgaris*, this dormancy state was broken as early as in late October under favorable conditions. In fact, the turion short-day requirement to break innate dormancy was fully satisfied as early as early September, whereas the low-temperature requirement was met after 55 days. In *Aldrovanda* turions, both in the field and outdoor culture, the short-day requirement was fully satisfied in early November. Turions stored at 4°C in darkness germinated at the end of January.

After their innate dormancy, turions of Canadian *U. vulgaris* enter a state of imposed dormancy at the end of October. This is maintained by low, unfavorable temperatures. This dormancy state is characterized by a decreasing level of abscisic acid and increasing levels of gibberellins, auxin, and cytokinins. When the imposed dormancy is broken by a temperature increase, the first turions germinate after two days. Breaking imposed dormancy begins germination. Low levels of abscisic acid and high levels of the other three stimulatory phytohormones correspond to this phase. In *Aldrovanda*, imposed dormancy breaks at 12-15°C.

Breaking imposed dormancy (which may not require light) is connected with the activation of respiration and partial starch conversion to free sugars. The density of *Aldrovanda* turions is reduced within 1-2 days so turions rise to the surface where they germinate in of warmer water, high light intensity, and increasing day

length. In duckweed turions, a small gas bubble (presumably CO_2 released from anaerobic respiration) is produced which pulls the turions to the water surface. This process can occur in darkness, but is more effective in light. The density of *Aldrovanda* turions may be similarly reduced by the production of CO_2 into the fine air spaces in leaves, expelling water from them. A photosynthetic origin of this gas is unlikely for *Aldrovanda*. Moreover, the net photosynthetic rate of dormant turions of bladderworts and *Aldrovanda* is very low or negative, even under optimum conditions. When turions are exposed to light after breaking imposed dormancy, they resume shoot growth (Figure 3). Although turion germination in itself is generally controlled by the photoreceptor phytochrome, great differences in light requirements exist between European carnivorous plants species. Turions of *U. australis* and *Aldrovanda* germinate at higher temperatures in light only. Those of *U. vulgaris, U. minor*, and *U. bremii* start germinating also in darkness and *U. vulgaris* even germinates in the refrigerator at 4°C.

Turion Ecology

Recent preliminary findings indicate only a minor percentage of *Aldrovanda* turions to overwinter successfully in the field (Kaminski, personal communication, 1994). This may be true for other aquatic carnivorous plant species. Therefore, overwintering may be a critical phase of the growing cycle of aquatic carnivorous plants. This has also been discovered by many carnivorous plant growers. In orientation growth experiments in enclosures with intact bottoms at natural sites in Poland, only 0-20% of the *Aldrovanda* turions survived. In growth experiments in bottomless enclosures in the Czech Republic, 0-70% of turions (on average, approximately 20-30%) survived. Some turions in the Trebon region (S. Bohemia) hibernated on the top of the wet bottoms and were grazed by small rodents. In the Doksy region (N. Bohemia), turions were commonly grazed by ducks. Herbivores rarely graze adult *Aldrovanda* but their grazing is focused on the energy-rich turions. When turions overwintered below water at the same or similar sites in the Trebon region, their survival was much higher (35-100%).

The rising of turions of aquatic carnivorous plants from the bottom is, in some species, their most susceptible phase. Turion release from the bottom is affected by how deep they are buried. In typical habitats of aquatic carnivorous plants in shallow reed and sedge stands, the greatest part of the litter, dead leaves and stems sinks to the bottom during the winter and during elevated water levels in spring. The denser these emergent stands, the more litter is available to bury the turions and impede their rising. It also increases the anoxia at the bottom. Duckweed turions do not germinate at O_2 shortage. The same may be true for carnivorous plant turions. Dense mats of filamentous algae or aquatic mosses may also impede rising turions. *Aldrovanda* turions entangled on the boundary between the bottom and free water may rot. However, turions of *U. minor, U.*

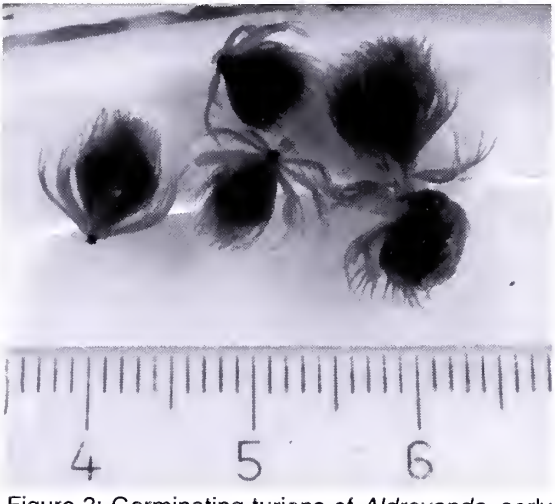

Figure 3: Germinating turions of *Aldrovanda*, early May 1997.

intermedia, and *U. ochroleuca*, which often grow in very shallow waters, often germinate at the bottom.

Dense stands of reeds and sedges are not suitable habitats for summer growth of aquatic carnivorous plants because of shading, nor are they suitable for successful turion overwintering. The low overwintering rate of *Aldrovanda* turions was observed after the wintering site had been trodden underfoot by roe-deer. Afterwards, many of the turions germinated as late as summer.

Acknowledgments

The paper is dedicated to my colleague Dr. Jan Kvet (Inst. Bot., Trebon, Czech Republic) on the occasion of his 65th birthday and for his whole life study of wetland plant ecology and great merits in wetland protection.

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NEPENTHES MOLLIS (NEPENTHACEAE)—REDISCOVERED?

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Keywords: taxonomy: *Nepenthes mollis*.
Received 15 July, 1997

On a recent trip to Borneo, one of the prime directives was to collect seed and pressed specimens of *N.* sp. from the book Pitcher-Plants of Borneo (Philipps and Lamb, 1997, pp 150-152). This species has been considered a hybrid in the past and is in the *N. maxima/veitchii/fusca* complex. We collected male specimens from G. Lumarku at 1700 m in tall dense forest on an exposed ridge line (Figure 1). After drying it for several months, I was then in a position to formally describe this species. While describing the stems and leaves I came across a drawing of *N. mollis* in Danser's monograph (Danser, 1928). It looked exactly like the pressed specimen

that I had in front of me. I then began to compare the two and found that they matched exactly, including the same hairiness, except for the following differences.

	N. mollis	*N.* sp.
Leaf Base:	Decurrent into 2 wings, 1 cm broad at the top, 4-6 cm long, gradually attenuate.	Decurrent for 1-2 cm.
Pedicels:	Without bract.	Bract originating from the base of the pedicel 3-4 mm long.

Figure 1: The intriguing *Nepenthes* from G. Lumarku, lower pitcher on the left, upper pitcher on the right.

To bring these differences into perspective, remember that the differences above are both from pressed herbarium specimens and that Danser never saw a live specimen of *N. mollis*.

In living specimens of *N.* sp. the base of the leaf is petiolate in the lower 4-5 cm with the leaf edges curled upwards. When pressed they are flattened and the leaf is narrowly lanceolate as in Danser's drawing of *N. mollis*. The leaf-sheathing on pressed plants of *N.* sp. is also flattened and looks decurrent instead. Without reference to a living plant you would be none the wiser. Could this also be the same with Danser's *N. mollis* specimen? The degree of supposed leaf decurrence and the bracts on the pedicels can be explained by natural variation within the wide range of this species. There are enough high mountains between those that contain *N.* sp. (G. Lumarku, G. Murud, Meligan Range) in the northwest and *N. mollis* (G. Kemul) in the southeast to provide a link between the two.

According to Danser, *N. mollis* reputedly lacks upper pitchers. *N.* sp. also exhibits this trait especially in the upper 70 cm of a flowering stem. Other *Nepenthes* are also known to abort pitchers at different times of the year when conditions of stress occur, i.e. during dry seasons. And to put the icing on the cake, Danser says about *N. mollis,* "It reminds one to the other species, *viz. N. fusca*, by its colour and its red-brown indumentum, but it differs by its quite other leaf shape and nervation, and its still denser indumentum." If my hypothesis is proved correct by recollection from the type locality, then the lower and upper pitchers of *N. mollis* would be described as follows.

Lower pitcher, abruptly incurved at the front or side from the hanging end of the tendril, 110-130 mm tall, 25-35 mm wide, ovate in the lower 1/3 becoming cylindrical and then inflated, narrowing abruptly towards the mouth with two fringed

wings over the entire length. The back of the pitcher mouth is elevated into a long neck converging towards the lid. Wings 2-3 mm wide, fringe segments filiform 4-8 mm long, 3-4 fringe segments per cm. Mouth ovate, horizontal in front, elevated strongly towards the lid with a long neck 30-40 mm long. Peristome rounded, 4-5 mm wide in front flaring widely 12-15 mm in the mid 1/3 narrowing attenuately towards the lid with ribs 0.5-0.8 mm apart, 1-1.5 mm long on the inner margin, pectinate. Inner surface of the pitcher glandular in lower 2/3 with minute elliptic overarched glands 0.15-0.2 mm long, the long axis of the glands orientated at right angles to the long axis of the pitcher, from the bottom to the top 900-2500 glands cm^{-2}, glands becoming larger and more rotund towards the bottom; the upper 1/3 glandless and pruinose. Lid triangular 35-40 mm long, 16-22 mm wide, cordate at the base, rounded at apex, the lower surface sparsely glandular with elliptic to rotund deepened and rimmed glands 0.1-0.3 mm long concentrated near the base. Lower midrib has a strongly hooked boss 2 mm long inserted at the base of the lid and a small glandular appendage inserted near the tip. Spur filiform, 8-12 mm long inserted 5 mm from the base of the lid. All outer surfaces except the peristome are covered with a dense red-brown indumentum, single hairs 1-1.5 mm long and shorter branched hairs 0.5 mm long.

Upper pitcher shortly curved at the rear from the hanging end of the tendril, 230-250 mm tall, 50-70 mm wide, infundibulate in the lower 1/2 becoming inflated then narrowing abruptly towards the mouth; without wings. The back of the pitcher mouth is elevated strongly towards the lid. Mouth ovate, horizontal in front, elevated strongly towards the lid with a long neck 60-70 mm long. Peristome rounded, 4-5 mm wide in front, flaring widely in the mid 1/3, 25-35 mm wide, narrowing attenuately towards the lid with ribs 1-1.2 mm apart, 2-2.5 mm long on the inner margin, pectinate. Inner surface identical to the lower pitcher but completely glandular. Lid identical in shape to the lower pitcher, 50-60 mm long, 30-35 mm wide, the boss 7 mm long, appendage 3 mm long; spur 25 mm long, inserted 12 mm from the base of the lid. Indumentum identical to the lower pitcher.

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Danser, B.H. 1928, *N. mollis* in: The Nepenthaceae of the Netherlands Indies, Bull. Jard. Bot. Buitenz. 3. ser. 9, 338-340.

Phillipps, A., and Lamb, A. 1997, in: Pitcher-Plants of Borneo, 113-114, 150-152.

Editor's comment (JS): The identity of the specimens from G. Lumarku with *N. mollis* should be proven by comparison with authentic pitchered material from G. Kemul. Unless this is done, the data above cannot be taken as an emendation of Danser's original description of *N. mollis* but are only referring to north Bornean plants without doubt. These latter have previously been attributed to *N. veitchii* or

Looking Back: CPN 25 years ago

Katsuhiko Kondo wrote about the obscure origins of the hybrid *Drosera* 'Nagamoto', which was later described as *Drosera* × *nagamotoi*, i.e. *D. anglica* × *D. spatulata*: "There is a hybrid...made by Mr. Jiro Nagamoto. The parents of the hybrid were *Drosera longifolia* (*anglica*) [*sic*] as the maternal parent from Hokkaido and *D. spathulata* [*sic*] as the paternal parent from Mt. Shinoda, Osaka (the Kansai type)." The story grows because it has since been demonstrated that the Kansai parent is actually the hybrid *D. rotundifolia* × *D. spatulata*!

Zamudio, S. 1998, Situación taxonómica de *Pinguicula orchidioides* DC. (Lentibulariaceae). Acta Botánica Mexicana, vol. 42, 7-13. (in Spanish with English abstract)

The long confused and dubious taxon *P. orchidioides* was reinvestigated. This time the respective type specimens and original descriptions were studied, and the conclusion is that *P. orchidioides* is, according to the present author, a recognizable species belonging to the taxonomically difficult section *Orcheosanthus* of *Pinguicula*. It is related to *P. oblongiloba* but differs by elliptical, narrowly ovate-oblong to lanceolate (vs. ovate-orbicular in *P. oblongiloba*) summer leaves, glabrous (vs. glandular) pedicels (erroneously called peduncles in the present text) except for their apical portion, elliptical to oblong-lanceolate (vs. obtuse oblong) corolla lobes, the irregular (vs. pear-shaped) form of the capsule with a distinctly beaked apex, and the formation of stolons (absent in *P. oblongiloba*). *P. orchidioides* is considered conspecific with the recently described *P. stolonifera* Luhrs. It occurs in Mexico (Guerrero, Oaxaca) and Guatemala.(JS)

Trebacz, K. & Sievers, A. 1998, Action Potentials Evoked by Light in Traps of *Dionaea muscipula*. Plant Cell Physiol., vol. 39, 369-372.

In the present paper it is shown that not only tactile stimuli but also discontinuous changes of light intensity (light pulses) can trigger action potentials in the traps of Venus' fly traps. Temperature changes have experimentally been excluded to be the effective signal. Inhibition of the photosynthetic electron transport chain blocked the generator potentials mediating between light absorption and action potentials. However, no observations on leaf blade movement were made. (JS)

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News & Views

Ivan Snyder (110 Meyer Court, Hermosa Beach, CA 90254) sent an interpretive pamphlet from a new trail that exhibits *Darlingtonia* in the Six Rivers National Forest, California. This pamphlet describes the native flora and fauna, and is nicely written, informative, and pleasantly accurate. The text's high point is a wooden platform where you can observe meat-eating *Darlingtonia* at a safe distance! The trailhead to this path is mile post 17.9 on Highway 199.

Ivan overlooking his dream-garden at Six Rivers.

Stanley Rehder (P.O. Box 484, Wilmington, NC 28402) sent us a glossy brochure that was printed by the Plant Conservation Program, North Carolina Department of Agriculture. This is yet another informative, accurate pamphlet! It describes Venus Flytraps, and the plant's form, ecology, cultivation, management, and conservation status are all discussed marvelously. The importance of periodic fires are noted, and a range map shows the thirteen counties of North and South Carolina (out of an original twenty) where Venus Flytraps still survive. Ten points to the these fine folks, who can be reached at 919-733-6930.

Sara Anne Gardner (515 Country Aire Drive, Grants Pass, OR 97526) informed us the BLM (Bureau of Land Management) was seeking public comment on plans to build a boardwalk at Eight Dollar Mountain Wayside Interpretive area, about five miles north of Cave Junction (visitors were damaging the site while sightseeing). The BLM was considering either leaving this *Darlingtonia* site alone, improving the

access so people could visit the site without damaging it, or improving the access so the site was wheelchair accessible. The ICPS contacted the BLM and advised them that the second route was the best option since leaving the site alone was damaging the site by neglect, and improving access would stabilize the trails and minimize further degradation. Making the site wheelchair accessible would have damaged the site unnecessarily since handicap-accessible *Darlingtonia* sites are nearby. A follow-up conversation with the Area Manager revealed the BLM decided to follow the plan the ICPS recommended. As an extra benefit, a vehicle road that passes through the wetland itself would be closed.

David Gray called in a last minute announcement about the 2000 Conference of the ICPS. The Bay Area Carnivorous Plant Society will be hosting this conference. The dates have been set for May 19-21, in the year 2000. The meeting will be held in the area of San Francisco or Berkeley, so attendees should start thinking about their travel plans. (Yes, it seems like a long way off, but the best travel deals can be made if you arrange them far in advance.) Registration forms will be made available in a future issue of Carnivorous Plant Newsletter, and on the ICPS web site. Plan to attend this meeting—there will be exciting presentations, field trips, and fun!

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OBSERVATIONS ON *CEPHALOTUS* IN THE WILD

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Keywords: travelogue: *Cephalotus follicularis*, Western Australia (Australia).

In June and December, 1995, I had the pleasure of seeing *Cephalotus follicularis* (see Back Cover) in the wild at two sites on the south coast of Western Australia, near Albany and Walpole. At both sites, the plants were not obvious and would have been overlooked had I not been told that the plants grew there.

At the site near Albany, the plants grew on a low sandy bench at the foot of a wooded slope and near a sedge swamp. The plants were difficult to find, growing at the base of a thicket of thin, multiply branched shrubs which were up to 3 m tall. Here they grew under sedges and other herbs. The plants occurred in an area approximately 3 m long by 1 m wide and were identified by the glossy, ovate non carnivorous leaves which were produced in greater abundance than the pitchers.

Approximately thirty rosettes grew at this site, many of which might be clones from the same root system. They had one to four ovate normal leaves and up to two pitchers each. The non-carnivorous leaves were up to 4 cm long and 2.5 cm wide and were generally held horizontally, perhaps to catch as much light as they could in this heavily shaded environment. The pitchers were up to 3 cm long, the majority of which were fully green; one pitcher with red pigment on its lid grew in a more open area. Many of the pitchers were partially to fully covered by the non-carnivorous leaves and also were partially buried by the thin layer of humus on the moist, sandy peat soil. In early June, the plants had no new growth (or at best very slow growing and immature growth emerging from their centres) but had several recently open to soon to open pitchers. In early December, all the plants had a new flush of pitchers and non-carnivorous leaves in various stages of development.

On my latest visit I opened one of the dying pitchers and investigated its diet (it was approximately six months old). It contained one purple isopod, or "slater," which was still intact and therefore appeared to have been recently caught; several small flies all less than 2 mm long; the chitinous remains of numerous black insects which probably included beetles and ants; and one white, worm-like insect larvae, approximately 2 cm long which was very much alive and feeding on this soup. There were two noticeable features of the plants at this site; the first was the lack of scapes and the other was the absence of a build up of dead *Cephalotus* leaves.

The second site, near Walpole, was visited in early summer and was very different. The plants grew on a cliffs at the back of a small and sheltered beach, in a peaty clay substrate through which fresh water was constantly flowing. In contrast to the other site, the plants grew in open areas amongst sedges and a few trees, and in this well lit conditions had abundant, brightly coloured pitchers and a few small non-carnivorous leaves. There were approximately ten mature plants in the area, consisting of low domes of pitchers up to 3 cm long. The plants were in active growth with pitchers and non-carnivorous leaves in numerous stages of growth. Many of these plants had scapes up to 30 cm tall, one of which had flowers which were a day or two from opening. Around the mature plants grew at least fifty red seedlings in an area of about 5 m^2. These plants had pitchers as large as 1.5 cm long, but most were smaller, perhaps indicating that they were less than a year old.

From discussions with Phill Mann who has visited many *Cephalotus* sites, it appears that this species grows in a cycle which lasts several years. *Cephalotus*

grows strongly after land disturbance and particularly after fire. Plants resprout from the unburned root system and produce abundant pitchers and flowers. Seedlings establish before competing vegetation does (particularly low, dense growing woody shrubs). After the woody competitors become dominant, *Cephalotus* declines in vigour and produces relatively more non-carnivorous leaves. The plants persist in this stage of slowed growth until the next fire. Both Phill Mann and Mark Stuart observed that in many swamps, elusive and hidden *Cephalotus* plants were most easily found by the sound of popping pitchers as the plants were stepped upon.

At both sites *Cephalotus* grew with other carnivorous plants, particularly the pink-petalled form of *Drosera pulchella*. At the site near Albany it also grew with or near *Drosera erythrorhiza* subsp. *erythrorhiza*, *D. erythrorhiza* subsp. *collina*, *D. pallida* and *D. neesii* subsp. *neesii*. At the site near Walpole the remains of *D. erythrogyna* were found nearby.

With permission from the land owners I removed a few leaves from the plants near Albany. These were placed in *Sphagnum* moss and peat moss; the leaf in the peat moss rotted but the two in the *Sphagnum* moss remained green. By August they had developed small roots, by December small non-carnivorous leaves and a few pitchers emerged from the callus at the base of the petiole, by February the mature leaf died but the plantlet at the base was growing well.

The conservation status of *Cephalotus* is secure particularly in cultivation; it is now grown around the world and propagated by seed, leaf and root cuttings and tissue culture. In the wild this species is a robust survivor. Its taxonomic isolation suggests it probably has a long history. It has survived in the coastal plain where sea levels have varied between flooding all but the high ground of the isolated low granitic hills, to times when extensive sand dunes and sand sheets covered the land. In addition the plants have survived a climatic change, fire and most land disturbances. Phill has reported that plants generally survive collection by resprouting vigorously from root fragments left behind; and he has seen some spectacular plants regrowing from such disturbance. The biggest threats to this species in the wild appear to be extensive land clearing for agriculture (especially if fertiliser is used), and from poisoning from polluted water. Fortunately many *Cephalotus* sites are protected in National Parks, Reserves and on privately owned blocks.

Acknowledgements: I wish to thank Todd James and his family for granting me permission to see the *Cephalotus* site on their property. Thanks also to Phill Mann for telling me of the site near Walpole, and for many interesting discussions.

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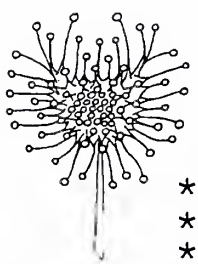

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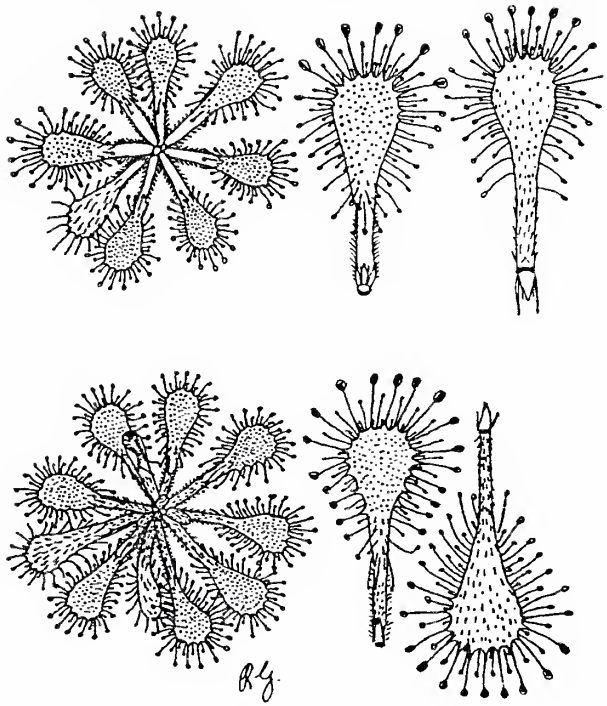
N. ventricosa
N. ventricosa × *alata*
N. ventricosa × ?
Pinguicula alpina—near Zilina
P. vulgaris
P. vulgaris—Vernar, Slovak
P. vulgaris—Slovenia
P. vulgaris—near Ceske
P. vulgaris—near Rudnany, Slovakia
P. vulgaris—near Martin
P. vulgaris—near Martin, inverse flower
P. vulgaris—near Turtianske, Slovak
P. vulgaris—near Bonneval, France
P. vulgaris—near Poprad, Slovakia
P. vulgaris—near Rabca
Sarracenia flava
S. flava—Ben Hill Co., Georgia
S. flava—New Bern, Craven Co., North Carolina
S. flava—Fitzgerald, Ben Hill Co., Georgia
S. leucophylla
S. minor—Fitzgerald, Ben Hill Co., Georgia
S. oreophila—green with small red veins
S. purpurea subsp. *purpurea*
S. purpurea subsp. *purpurea*—north Ohio plains
S. purpurea—red ruffles (2)
S. minor & *psittacina*—Fitzgerald, Ben Hill Co., Georgia, seeds mixed
S. alata × *leucophylla*
S. flava × *rubra*—green with gold tops
S. leucophylla × *minor*
S. leucophylla × *oreophila* selfing
S. oreophila × *purpurea* subsp. *purpurea* selfing
S. oreophila × *rubra* selfing
Drosera admirabilis
D. aliciae
D. anglica—N. Slovakia
D. anglica—(California × Hawaii clones)
D. binata
D. binata var. *dichotoma*—red
D. burkeana
D. burmannii
D. burmannii—Beerwah, Queensland
D. burmannii—hybrid (?)
D. capensis—green
D. capensis—white flower
D. capensis—purple flower
D. capillaris
D. derbyensis
D. filiformis var. *filiformis*
D. filiformis var. *filiformis*—North Carolina
D. fimbriata
D. glanduligera
D. lowriei
D. lowriei—small red form
D. macrantha subsp. *macrantha*
D. macrantha subsp. *macrantha*—pink
D. montana
D. nidiformis
D. ordensis
D. platypoda
D. rotundifolia—Czech Republic
D. rotundifolia—Del Norte Co., California
D. rotundifolia—Mendocino Co., California
D. rotundifolia—Nevada Co., California
D. rotundifolia—Plumas Co., California
D. sessilifolia
D. spatulata
D. spatulata—hairy sepals, Gympy, Queensland
D. spatulata—pink flower
D. stolonifera subsp. *stolonifera*
D. sp.—Magaliesburg
D. sp.—Rhodesia
D. dielsiana × sp. Transvaal

Miscellaneous:
Ibicella lutea—5 seeds per packet
Mimosa pudica—sensitive plant

A number in parentheses indicates limited numbers of seed packets remaining.

$1 per packet, IRCs accepted. All correspondence and orders within the US must include a self-addressed, stamped envelope. Postage is $.32 for a seedlist, $.43 when ordering seed. All correspondence with the seedbank must be accompanied by a self addressed stamped envelope. All seed contributions are gratefully accepted. Please use bubble wrap to protect the seeds from postal abuse—this will require additional postage for shipping.



Drosera sketches by Robert Gibson: *D. dielsiana* (top) and *D. natalensis* (bottom).

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Species	Price	Origin
C. follicularis (2 plants, 1-2" each)	$15	Australia
H. heterodoxa (divisions, 4" tall)	$80	Venezuela
H. ionasi	$80	Ilu Tepui, Venezuela
H. minor (divisions, 4" tall)	$80	Auyan-Tepui, Venezuela
H. nutans (divisions, 4", tall)	$80	Cerro Kukenan, Venezuela
H. nutans	$38	Cerro Kukenan, Venezuela
N. alata	$20	Philippines
N. alata, red trap(rooted cutting, 4-6" diam)	$40	Philippines
N. albo-marginata (spotted)	$40	Malaysia
N. albo-marginata-red	$35	Malaysia
N. ampullaria	$35	Borneo
N. ampullaria	$35	Sipitang, Borneo
N. bicalcarata (>3" diameter)	$65	Borneo
N. bongso (talangensis)	$50	G. Talang, Indonesia
N. burbidgeae	$125	Kinabalu
N. burkei	$35	Philippines
N. caranculata	$48	G. Sago, Sumatra,Indonesia
N. clipeata	$99	Malaysia
N. edwardsiana (1.5")	$125	Trus Madi, Sabah, Malaysia
N. deaniana	$65	Palawan
N. ephippiata	$77	G. Rajah, Kalimantan
N. eustachya	$77	
N. eymae (*N. infundibuliformis*)	$55	G. Lumut, Sulawesi, Indonesia
N. fusca	$40	
N. fusca	$40	Tambunon Road near Trus Madi
N. gracilis	$10	Talangka Rajah, Borneo
N. gracilis (12" vine)	$34	
N. gracillima	$44	Genting Highlands, Malaysia
N. gymnamphora	$47	G. Singalang, Sumatra
N. hirsuta (rooted cutting, 4-6" diam)	$35	Malaysia
N. insignis	$59	E. Btak, Indonesia
N. khasiana	$15	Assam, India
N. lowii	$60	Brunei
N. lowii	$60	G. Mulu, Sarawak, Malaysia
N. lowii	$60	Trus Madi, Sabah, Malaysia
N. lowii	$75	G. Murud, 2060 meters
N. lowii	$75	M. Kinabalu
N. macfarlanei	$40	Genting Highlands, Malaysia
N. madagascariensis	$15	Madagascar
N. maesolensis	$55	Madagascar
N. maxima	$30	Rantepao, S. Sulawesi,Indonesia
N. maxima	$47	Anggi Lakes
N. maxima (>6" rooted cutting, produces numerous 6" speckled traps)	$55	Indonesia
N. merrilliana	$70	Nunok Island
N. mirabilis	$12	Kelam, Borneo
N. mirabilis	$12	Cape York, Australia
N. mirabilis (Echinostoma)	$55	
N. muluensis	$85	G. Mulu
N. murudensis	$77	G. Murud
N. neoguniensis	$82	Irian Jaya
N. northiana	$82	Near School, Bau, Sarawak
N. pectinata	$75	G. Singalang, Sumatra
N. pervillei	$35	Seychelles
N. rafflesiana	$37	Malaysia
N. rajah	$40	Mt. Kinabalu, Sabah, Malaysia
N. reinwardtiana	$40	G. Silam
N. sanguinea (>4" diam)	$35	Genting Highlands, Malaysia

Species	Price	Origin
N. sp.	$45	Legaspi, Phillipines
N. spectabilis (rooted cutting)	$65	Malaysia
N. spathulata	$85	Greenhouse
N. stenophylla	$55	Baria, Sarawak, Malaysia
N. tentaculata	$45	Mt. Kinabalu, Sabah, Malaysia
N. tentaculata	$45	G. Murud
N. thorelii	$45	Phuk Radung, E. Thailand
N. tobaica	$45	
N. tomoriana	$50	Lampia, Gulf of Tomori, Sulawesi
N. treubiana (*N. sumatrana*)	$80	Sumatra
N. treubiana(*N. sumatrana*) (6" diam)	$136	Sumatra
N. truncata	$50	Philippines
N. truncata (>5" diam)	$85	Philippines
N. truncata (>14" diam)	$195	Philippines
N. veitchii (highland)	$60	Batu Lawi, Sarawak, Malaysia
N. veitchii (lowland)	$60	Sungai Samba, Borneo
N. ventricosa (>4" diam)	$9	Philippines
N. ventricosa >6" diam, rooted cutting, develops large (8") green traps with dark red peristome, very unusual!)	$35	Philippines
N. vieillardii (>4" diam)	$40	New Caledonia
N. villosa (1.5" diam)	$100	Mt. Kinabalu, Sabah, Malaysia
Selected hybrids		
N x (*bicalcarata* x *ampullaria*)	$35	Siputang, Sabah, Borneo
N x (*bongso* x *maxima*)	$55	
N x (*fusca* x *burbidgeae*)	$50	
N x *hookeriana*	$45	Natural hybrid between *N. rafflesiana* and *N. ampullaria*
N x (*khasiana* x *truncata*)	$30	
N x (*mirabilis* x *khasiana*)	$30	
N x (*singalana* x *truncata*)	$30	
N x (*spathulata* x *veitchii*)	$50	
N x (*thorelii* x *veitchii*)	$37	
N x (*truncata* x *maxima*)	$50	
N x (*truncata* x *ventricosa*)	$45	
N x (*veitchii* x *lowii*)	$55	
N x (*ventricosa* x *mirabilis*)	$35	
Victorian Hybrids		Unique and Spectacular Traps
N x chelsonii (>6" rooted cutting)	$30	London, Late 1800's
N x coccinea (>6" rooted cutting)	$30	London, Late 1800's
N. x dormaniana (>6" root. cutting)	$30	London, Late 1800's
N x dyeriana (>6" rooted cutting)	$65	London, Late 1800's
N x edinensis (>6" rooted cutting)	$25	London, Late 1800's
N. x mixta (>6" rooted cutting)	$55	London, Late 1800's
N x wrigleyana (>6" rooted cutting)	$35	London, Late 1800's
Books		
Nepenthes of Mt. Kinabalu Original Edition	$75	Price includes shipping/handling
Nepenthes of Borneo C. Clarke	$65	Price includes shipping/handling

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Instructions to Authors

Carnivorous Plant Newsletter is the journal of The International Carnivorous Plant Society. It is dedicated to the distribution of knowledge about carnivorous plants, including information on cultivation, conservation, and related fields of general and applied botany. Carnivorous Plant Newsletter thrives only because of a steady stream of material from its readership; members of the Society are encouraged to submit articles.

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